

REMARKS

Reconsideration is respectfully requested of the rejection of claims 1-5, 7, 9-22, and 24-36 under 102(b) over Eisenmann incorporating Wallace.

Claims 1, 17, 18, and 20 have been amended to clarify the nature of the invention. Support for the amendment can be found, for example, at page 20, lines 5-7 (paragraph 0050 of the published application) and page 8, lines 21-27 (paragraph 21 of the published application) of the specification.

For a prior art reference to anticipate a claim under Section 102(b), the prior art reference must teach each and every element of the claim. Claim 1 expressly requires maintaining a contaminant concentration level in the purifying liquid which is lower than the contaminant concentration level in the electrolyte during the purification step. Eisenmann/Wallace does not disclose or suggest a process in which the purifying liquid is so maintained. Eisenmann/Wallace therefore does not anticipate claim 1.

The Eisenmann/Wallace process involves removing charged ions from a first rinse solution by electrodialysis and from a second rinse solution by Donnan dialysis. Neither electrodialysis nor Donnan analysis is a purification step involving maintaining a contaminant concentration level in the purifying liquid which is lower than the contaminant concentration level in the electrolyte during the purification step.

Electrodialysis employs an electrical current to drive ions in one solution through a membrane into another solution:

A solution containing the charged ions to be recovered (the feed solution) is passed through the compartments in contact with the membranes and an electrical potential is applied across the system by means of electrodes contained in compartments at each end of a membrane stack. Under the influence of the electrical potential anions are forced in one direction through the anion permeable membrane while cations are simultaneously forced through the cation permeable membranes in the other direction, thus concentrating the charged ions in alternate compartments and diluting them in adjacent ones. Eisenmann Col. 1, line 54.

In Eisenmann's example involving purification by Ni removal described in column 4 and depicted in his Figure, the Ni concentration in the electrodialysis unit 16 is about 70-80 grams/liter (col. 4, lin 39), while the Ni concentration in the first rinse 12 from which Ni is being removed is about 1 gram/liter (col. 4, line 32). The electrical potential of the electrodialysis unit essentially *thrusts* the Ni ions out of the first rinse 12 and *concentrates* them in the purification solution. Nickel ions --- Eisenmann's contaminant --- are at a much greater concentration in the purification solution than they are in the working solution being purified. Accordingly, Eisenmann's electrodialysis operation does not involve "maintaining a concentration level of contaminants in the purification liquid during the purification step which concentration level is lower than a concentration level of contaminants in the electrolyte." Rather, in sharp contrast, the concentration level of contaminants in Eisenmann's purification liquid is on the order of 70 times the level in the solution being cleaned.

Donnan dialysis relies on common electrical charge to have a charged ion in a stripping solution force a different ion, though similarly charged, out of the working solution:

The process acts to replace either the anions or cations in the feed solution (depending on the type of ion exchange membrane used) with the replacement anion or cation being supplied by the stripping solution. The driving force is the concentration difference between the similarly charged ions in the feed and stripping solutions and the process acts to replace the feed solution ions, in contrast to electrodialysis which removes the feed solution ions. Eisenmann Col. 2, ln. 3.

The stripper ions and contaminant ions removed have the same charge, but they are different species. In Eisenmann the stripper ions are H cations (from sulfuric acid) and the contaminant ions removed are Ni cations. (Similarly, in Wallace

the cleaner ions are H cations [from nitric acid] and the contaminant ions removed are uranyl cations.) Specifically, in Eisenmann's example described in column 4, lines 55-66, sulfuric acid ( $H_2SO_4$ ) in the stripping solution provides H ions which replace Ni ions in the working solution (rinse 14). Hydrogen ions essentially force the Ni ions out of the second rinse 14 and concentrate Ni ions in the purification solution. The Ni ion concentration in the second rinse 14 is under 100 parts per million, while the Ni ion concentration in the purification solution is much higher (up to 20 grams/liter). Col. 5, lns. 61-col. 6, line 1. Nickel ions --- Eisenmann's contaminant --- are at a greater concentration in the purification solution than they are in the solution 14 being purified. Accordingly, Eisenmann's Donnan dialysis operation does not involve "maintaining a concentration level of contaminants in the purification liquid during the purification step which concentration level is lower than a concentration level of contaminants in the electrolyte."

The Office states on page 2 of the Office action, citing passages from Eisenmann and Wallace, that the references disclose control of concentration gradient. While as a general proposition concentration of stripper ions (not contaminant ions) is of interest in Eisenmann/Wallace's Donnan dialysis, neither process maintains contaminant ion concentration level in the purification solution below contaminant concentration level in the working solution. Rather, in both processes the contaminant level in the purification solution substantially exceeds contaminant level in the working solution.

In view of the foregoing, Eisenmann/Wallace fails to disclose or suggest the express requirements of claim 1.

With specific regard to claim 2, it is patentable because it depends from claim 1 and therefore also requires maintaining contaminant concentration level in the purification solution below contaminant concentration level in the working solution. Claim 2 is further patentable because it requires maintaining

contaminant concentration in the purifying liquid below a preselected level. Eisenmann, neither in the cited passage col. 6, lns. 4-8 or anywhere else, discloses this. This passage discloses maintaining the *stripping ions*, not the contaminant ions, at a particular level. Similarly, in Wallace col. 2, lns. 60-65, the concern with the stripping solution is with the concentration of *stripping ions*, not with contaminant ions.

With specific regard to claim 3, it is patentable because it depends from claim 1 and therefore also requires maintaining contaminant concentration level in the purification solution below contaminant concentration level in the working solution. Claim 3 is further patentable because it requires maintaining contaminant concentration in the purifying liquid substantially constant. Eisenmann and Wallace, in contrast, were concerned with maintaining a *stripping ion* concentration in the stripping solution. Their contaminant (Ni for Eisenmann; uranyl for Wallace) ion concentration in the stripping solution steadily increases during purification.

Along these same lines, method claims 4-5, 7, and 9-19 similarly require maintaining contaminant concentration level in the purification solution below contaminant concentration level in the working solution, and are therefore patentable for the same reasons as claim 1.

With regard to claims 20-22 and 24-36, they are directed to an apparatus not disclosed or suggested by Eisenmann/Wallace. A fundamental distinction between the respective apparatuses is that applicants' apparatus specifically requires the following:

"a separating unit ... such that by maintaining a concentration level of contaminants in the purification liquid during a purification step which concentration level is lower than a concentration level of contaminants in the electrolyte... contaminants pass under a contaminant driving force gradient between the electrolyte and the purifying liquid so contaminants transfer from the electrolyte into the purifying liquid."

In contrast, the separating units of the Eisenmann/ Wallace electrodialysis and Donnan dialysis units are ion exchange membranes:

Ion exchange membranes are used in both Donnan dialysis and electrodialysis .... Eisenmann col. 5, ln. 14.

Such units ... contain both cation and anion exchange membranes formed as thin sheets of ion-exchange material.... Eisenmann Col. 3, ln. 51.

As noted above, in the Eisenmann process the electrical potential of the electrodialysis unit essentially *thrusts* the Ni ions out of the first rinse 12 and *concentrates* them in the purification solution:

Under the influence of the electrical potential anions are forced in one direction through the anion permeable membrane while cations are simultaneously forced through the cation permeable membranes in the other direction, thus concentrating the charged ions in alternate compartments and diluting them in adjacent ones. Eisenmann, col. 1, ln. 60.

Nickel ions --- Eisenmann's contaminant --- are therefore at a much greater concentration in the purification solution than they are in the working solution being purified. Accordingly, Eisenmann's apparatus does not contain the separating unit required in claim 20.

Similarly, in the Eisenmann/Wallace Donnan dialysis, H ions essentially force the Ni ions out of the second rinse 14 and concentrate Ni ions in the purification solution. The Ni ion concentration in the second rinse 14 is under 100 parts per million, while the Ni ion concentration in the purification solution is much higher (up to 20 grams/liter). Col. 5, lns. 61- col. 6, line 1. Nickel ions --- Eisenmann's contaminant --- are at a greater concentration in the purification solution than they are in the solution 14 being purified. It is therefore evident the Eisenmann/Wallace Donnan dialysis apparatus also lacks the separating unit of claim 20.

Inasmuch as Eisenmann/Wallace fails to disclose or suggest this separating unit required by claim 20, the claim is neither anticipated nor rendered obvious thereby.

Claims 21-22 and 24-36 require the same separating unit as claim 20. These claims are therefore patentable for the same reasons as claim 20, and further due to the additional requirements they contain.

Reconsideration is requested of the rejection of claims 6, 8, and 23 as unpatentable under Section 103 over Eisenmann in view of Tsai et al.

For a combination of prior art references to render obvious a claim under Section 103, the combination must teach each and every element of the claim. Claims 6 and 8 expressly require maintaining a contaminant concentration level in the purifying liquid which is lower than the contaminant concentration level in the electrolyte during the purification step. As explained above in connection with claim 1, Eisenmann/Wallace does not disclose or suggest a process in which the purifying liquid is so maintained. Nor do Tsai et al. disclose or suggest such a process. Eisenmann/Wallace in combination with Tsai et al. therefore does not render obvious claims 6 and 8.

With regard to claim 23, it is an apparatus claim requiring the same separating unit as claim 20, and is therefore patentable for the same reasons as stated above for claim 20.

With regard to new claims 37-48, they depend from claims 1, 17, and 18, each of which require maintaining a contaminant concentration level in the purifying liquid which is lower than the contaminant concentration level in the electrolyte during the purification step. These claims are therefore patentable for the reasons stated in connection with claim 1. These claims are also patentable because they require removal of specific contaminants not disclosed or otherwise contemplated by the cited references.

Support in the specification for new claims 37-39 can be found in the paragraph bridging pages 1 and 2 of the

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specification (paragraph 0004 of the published application). Support for claims 40-46 can be found in the paragraph bridging pages 3 and 4 of the specification (paragraph 0008 of the published application). Support for claims 47-48 can be found in the paragraph bridging pages 2 and 3 of the specification (paragraph 0007 of the published application).

\* Enclosed a check for \$326.00 for a one-month extension and 12 additional new claims.

In view of the foregoing, applicants respectfully request issuance of a Notice of Allowance for claims 1-48.

Respectfully submitted,



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